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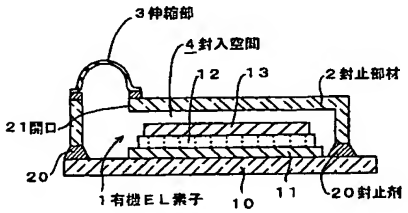
(54)【発明の名称】有機ＥＬ表示装置

(57)【要約】

【課題】有機ＥＬ表示装置の封止構造の改良により、温度変動による内圧の変動を小さくして、信頼性を向上させる。

【解決手段】封止部材の少なくとも一部に、封入空間の体積を増減可能に伸縮する伸縮部を備えた。温度の変化により内圧が変動すると、それに伴って伸縮部が伸縮して封入空間の体積が増減されるため、ボイル・シャルルの法則により内圧の変動が緩和される。



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【特許請求の範囲】

【請求項１】　基板と該基板上に形成された第１電極層と該第１電極層上に形成された有機ＥＬ発光層と該有機ＥＬ発光層上に形成された第２電極層とよりなる有機ＥＬ素子と、該有機ＥＬ素子を気密に封止する封止部材とよりなり、該有機ＥＬ素子と該封止部材との間に形成される封入空間内に不活性物質を封入してなる有機ＥＬ表示装置において、

該封止部材の少なくとも一部に該封入空間の体積を増減可能に伸縮する伸縮部を備えたことを特徴とする有機ＥＬ表示装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、有機材料からなる発光層をもつ有機ＥＬ素子を気密に封止した有機ＥＬ表示装置に関する。

【０００２】

【従来の技術】表示用ディスプレイデバイスとしては、ブラウン管（Cathode Ray Tube）、液晶（Liquid Crystal）、プラズマ（Plasma）、発光ダイオード（Light EmittingDiode）及びＥＬ（Electro Luminescence）などが従来より知られ、コンピュータ用ディスプレイ、液晶ディスプレイのバックパネルなどに広く利用されている。

【０００３】この中でもＥＬは自発光形であり、また薄膜とすることができるために薄い表示素子として期待されている。そして薄膜型直流ＥＬとして、低電圧で駆動できる有機薄膜ＥＬが近年注目を集めている。例えばフルカラー用ディスプレイとするためには、赤、緑、青の３原色を効率よく発光する素子が必要であるが、無機ＥＬでは青色については発光効率の低い材料しかない。しかし有機ＥＬによれば、青色も効率よく発光できる素子が開発され、フルカラー用ディスプレイへの応用が盛んに研究されている。

【０００４】ところが有機ＥＬ素子に用いられる有機発光材料は、耐水性が低く、湿気により寿命が短くなるという欠点がある。また有機ＥＬ素子に用いられているＭｇ合金などの金属電極も、水や酸素に対する耐性が低いという欠点がある。そこで従来より、有機ＥＬ素子を封止部材内に封止し、有機ＥＬ素子と封止部材との間に形成される封入空間内に窒素ガスなどを封入した有機ＥＬ表示装置が用いられている。

【０００５】例えば図４に示す従来の有機ＥＬ表示装置は、有機ＥＬ素子 100と封止ガラス200とから構成されている。このうち有機ＥＬ素子 100は、ガラス基板 101と、ガラス基板 101上に形成されたＩＴＯ（インジウム錫酸化物）などの透明電極層102と、透明電極層 102上に形成された有機ＥＬ発光層 103と、有機ＥＬ発光層103上に形成された金属電極層 104とより構成されている。また封止ガラス 200は一面に開口をもつ箱状をなし、封止ガラス 200の開口周縁部がガラス基板 200に接着剤などの封止剤 201によって接合されている。

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【０００６】この有機ＥＬ表示装置では、有機ＥＬ素子 100と封止ガラス 200とで密閉空間が形成され、有機ＥＬ素子 100と封止ガラス 200の間に形成された封入空間 300には窒素ガスが充填されている。この有機ＥＬ表示装置では、透明電極層 102、有機ＥＬ層 103及び金属電極層104は外部と遮断されて窒素ガスのみが接触するため、劣化が防止され長寿命となる。

【０００７】

【発明が解決しようとする課題】ところが上記した従来の有機ＥＬ表示装置では、温度の変化により封入された窒素ガスの圧力が変動し、高温下では内圧が高くなる。そのため高くなった内圧による応力は剛性の低い封止剤 201などに作用し、有機ＥＬ表示装置の信頼性を低下させるという不具合があった。

【０００８】本発明はこのような事情に鑑みてなされたものであり、有機ＥＬ表示装置の封止構造の改良により内圧の変動を小さくして、信頼性を向上させることを目的とする。

【０００９】

【課題を解決するための手段】上記課題を解決する本発明の有機ＥＬ表示装置の特徴は、基板と基板上に形成された第１電極層と第１電極層上に形成された有機ＥＬ発光層と有機ＥＬ発光層上に形成された第２電極層とよりなる有機ＥＬ素子と、有機ＥＬ素子を気密に封止する封止部材とよりなり、有機ＥＬ素子と封止部材との間に形成される封入空間内に不活性物質を封入してなる有機ＥＬ表示装置において、封止部材の少なくとも一部に封入空間の体積を増減可能に伸縮する伸縮部を備えたことにある。

【００１０】

【発明の実施の形態】本発明の有機ＥＬ表示装置では、封止部材の少なくとも一部に封入空間の体積を増減可能に伸縮する伸縮部が備えられている。したがって温度の変化により内圧が変動すると、それに伴って伸縮部が伸縮して封入空間の体積が増減されるため、ボイル・シャルルの法則により内圧の変動が緩和される。

【００１１】例えば高温下で内圧が高くなると、伸縮部が膨張して封入空間の体積が増大するため内圧が低下する。また低温下で内圧が低くなると、伸縮部が収縮して封入空間の体積が減少するため内圧が上昇する。したがって本発明の有機ＥＬ表示装置では、温度が変動しても封入空間の内圧の変動が少ないため、封止剤などに応力が作用するのが防止され、信頼性が向上する。

【００１２】有機ＥＬ素子としては、例えばガラス基板上にＩＴＯ膜などから第１電極層を形成し、第１電極層上に有機ＥＬ発光層を形成し、有機ＥＬ発光層上に第２電極層を形成したものなど、従来用いられているものを用いることができる。基板としては、通常ガラス基板が

用いられるが、合成樹脂基板を用いることもできる。また基板は一般に透明であるが、第２電極層に透明なものを用いれば、基板は不透明とすることもできる。

【００１３】第１電極層の材料としては、従来と同様にＩＴＯ、ＡＺＯ（Ａｌ添加ＺｎＯ）、SnO_2 などが例示され、スパッタリングなどで第１電極層が形成される。第１電極層のパターンは特に制限されず、ストライプ状など従来と同様のパターンに形成することができる。透明な基板を用いて基板側から発光させる場合には、この第１電極層もＩＴＯなどから透明電極層とする必要があるが、第２電極層を透明として第２電極側から発光させる場合には第１電極層は不透明な導電性金属から形成することもできる。

【００１４】有機ＥＬ発光層は、正孔輸送層と、正孔輸送層上に形成された発光体層と、発光体層上に形成された電子輸送層とから、従来と同様に構成することができる。この有機ＥＬ発光層は、真空蒸着法、ラングミュアブロジェット蒸着法、ディップコーティング法、スピンコーティング法、真空気体蒸着法、有機分子線エピタキシ法などを用いて形成することができる。

【００１５】第２電極層の材料としては、Ｍｇ－Ａｇ合金、Ａｌなどの導電性金属が例示される。この第２電極層は、有機ＥＬ発光層上に形成するため、スパッタリングなどの高温が作用する成膜法は用いられない。したがって蒸着法などで形成できる材料から選択される。封止部材としては、従来と同様にガラス、樹脂などを用いることができ、その形状は有機ＥＬ素子を覆うものであれば特に制限されない。また封止部材は、接着剤などの封止剤で有機ＥＬ素子の基板に接合して有機ＥＬ素子とともに封入空間を構成してもよいし、封止部材のみで封入空間を構成しその内部に有機ＥＬ素子を封止することもできる。

【００１６】封止部材と有機ＥＬ素子の第２電極層との間隔は、一般に 100～ 200μｍとされる。この間隔が狭すぎると、封止部材と有機ＥＬ素子とが接触して有機ＥＬ素子が損傷するおそれがある。また封入空間内に封入される不活性物質としては、有機ＥＬ素子、封止部材及び封止剤に対して不活性なものであればよく、窒素ガス、ヘリウムガス、アルゴンガスなどの不活性ガス、あるいはフッ素系の不活性液体を用いることができる。

【００１７】本発明の最大の特徴は、封止部材の少なくとも一部に封入空間の体積を増減可能に伸縮する伸縮部を備えたところにある。この伸縮部としては、例えば風船状あるいは蛇腹状に封止部材の一部から突出する伸縮自在な凸部とすることができる。このような凸部を設けることにより、温度変動により封入空間の内圧が変動すると凸部が膨張又は収縮する。これにより封入空間の体積が変動するため、封入空間の内圧は元の内圧との差が小さくなる方向に移動し封止剤などに作用する応力が小さくなる。

【００１８】伸縮部を凸部とした場合には、伸縮部は封止部材の開口に気密に接合される。この接合は、物理的あるいは化学的に接合すればよいが、伸縮部の伸縮時に気密が破壊されないように接合する必要があるので、物理的な接合と接着など化学的な接合の両方を併用することが望ましい。また封止部材全体を伸縮部とすることもできる。例えばゴムなどの気密な袋の開口を有機ＥＬ素子のガラス基板に接合して封止部材とすれば、温度変動により封入空間の内圧が変動すると封止部材自体が膨張又は収縮する。これにより封入空間の体積が変動するため、封入空間の内圧は元の内圧との差が小さくなる方向に移動し封止剤などに作用する応力が小さくなる。

【００１９】伸縮部の材質としては、封入される不活性物質に対して耐性を有し、不活性物質の膨張・収縮に応じて伸縮するものであればよく、フッ素ゴム、ブチルゴムなどのゴム系のもの、熱可塑性エラストマ、ポリブタジエンなどの樹脂系のものなどが例示される。

【００２０】

【実施例】以下、実施例により本発明を具体的に説明する。

（実施例１）図１に本発明の有機ＥＬ表示装置の断面図を示す。この有機ＥＬ表示装置は、有機ＥＬ素子１と封止部材２及び伸縮部３から構成されている。

【００２１】有機ＥＬ素子１は、ガラス基板10と、ガラス基板10上に形成されたＩＴＯ膜からなる第１電極層11と、第１電極層11上に形成された有機ＥＬ発光層12と、有機ＥＬ発光層12上に形成されＭｇ－Ａｇ合金よりなる第２電極層13とから構成されている。第１電極層11は、スパッタリングによりガラス基板10上にストライプ状に形成され、その厚さは1000～2000Åである。また有機ＥＬ発光層12は、第１電極層11上及びガラス基板10上の全面に形成された正孔輸送層と、正孔輸送層上に形成された発光体層と、発光体層上に形成された電子輸送層とから構成され、それぞれ公知の有機材料から蒸着法により形成されて、全体の厚さは1000～1500Åとなっている。

【００２２】そして第２電極層13は、マスクを介して蒸着法により厚さ1500～2000Åに形成され、第１電極層11に対して直交するストライプ状となっている。したがってこの有機ＥＬ素子１は、第１電極層11と第２電極層13を介して有機ＥＬ発光層12に直流電圧を印加することにより発光し、その発光は透明な第１電極層11とガラス基板10を透過してガラス基板10側から視認される。また第１電極層11と第２電極層13とで形成されるマトリクスの所定点を選択して通電すれば、その点が画素となるので、ディスプレイとして画像を表示することが可能となる。

【００２３】封止部材２はガラス板から箱状に形成され、その開口周縁部が有機ＥＬ素子１の第１電極層11、有機ＥＬ発光層12及び第２電極層13を覆うように、封止剤20によってガラス基板10に接合されている。そして封

止部材２の上面の一部には開口21が設けられ、袋状の伸縮部３の開口周縁部が開口21の周縁部に気密に接合されている。この開口21は、第１電極層11、有機ＥＬ発光層12及び第２電極層13が存在せずに表出するガラス基板10の表面に対向して設けられている。

【００２４】伸縮部３は軟質のフッ素ゴムから気密な袋状に形成されている。そして伸縮部３の開口周縁部が開口21の周縁部に気密に接合され、ガラス基板10、封止部材２及び伸縮部３により気密な封入空間４が形成されている。なお、封入空間４の体積は全体で１．５ｃｍ^{3}であり、伸縮部３内の容積は１．５ｃｍ^{3}である。封止剤20によるガラス基板10と封止部材２との接合、及び封止部材２と伸縮部３の接合には、紫外線硬化型の接着剤が用いられている。このように紫外線硬化型の接着剤を用いることで、接着時に高温となって有機ＥＬ素子１が劣化するような不具合が防止されている。

【００２５】封入空間４には窒素ガスが封入され、その圧力は室温（２５℃）において１気圧となるように設定されている。封入空間４への窒素ガスの封入は、封止部材２に予め伸縮部３を接合しておいたものを、窒素ガス中で封止剤 20により有機ＥＬ素子１のガラス基板10に接合することで行うことができる。本実施例の有機ＥＬ表示装置では、封入空間４内に窒素ガスが封入されているので、有機ＥＬ素子１が水分や酸素によって劣化するのが防止されている。そして温度が高温となって封入された窒素ガスが膨張すると、その圧力により伸縮部３が膨張する。これにより窒素ガスの圧力が低下し、伸縮部３の弾性による収縮力と窒素ガスの圧力とがバランスした状態で平衡となる。したがって封止部20に大きな応力が作用するのが防止され、有機ＥＬ表示素子１の寿命を長くすることができる。

【００２６】また温度が低温となって窒素ガスの圧力が低下すると、伸縮部３が収縮して封入空間４の体積が小さくなる。これにより窒素ガスの圧力が上昇するため、大気からの圧力により封止部20に大きな応力が作用するのが防止されている。さらに温度が低下すると、伸縮部３が封止部材２の内側へ侵入する場合が考えられるが、開口21が第１電極層11、有機ＥＬ発光層12及び第２電極層13が存在せず表出するガラス基板10の表面に対向して設けられているので、伸縮部３が有機ＥＬ素子１に接触して有機ＥＬ素子１が損傷するような不具合がない。

【００２７】（実施例２）本実施例の有機ＥＬ表示装置を図２に示す。この有機ＥＬ表示装置は、伸縮部３の形状と封止部材２への接合位置が異なること以外は実施例１と同様に構成されている。伸縮部材３は一端部が塞がれた蛇腹形状をなし、その他端開口の周縁部が封止部材２の開口22の周縁部に接合されている。また開口22は、

有機ＥＬ素子１に対向して設けられている。

【００２８】本実施例の有機ＥＬ表示装置では、伸縮部３は高温及び低温時に実施例１の伸縮部３と同様に作用して、封止剤20に大きな応力が作用するのが防止される。そしてきわめて低い温度になって伸縮部３が大きく収縮しても、伸縮部３は蛇腹部によって封止部材２の内側へ侵入するのが規制されているので、有機ＥＬ素子１に接触するような不具合がない。

【００２９】したがって本実施例の有機ＥＬ表示装置によれば、実施例１の有機ＥＬ表示装置に比べて封止部材２の開口22の位置の自由度が高い。

（実施例３）本実施例の有機ＥＬ表示装置を図３に示す。この有機ＥＬ表示装置は、実施例１と同様の有機ＥＬ素子１と、軟質な封止部材２’とから構成されている。

【００３０】封止部材２’はフッ素ゴムから気密な袋状に形成され、その開口周縁部が有機ＥＬ素子１の第１電極層11、有機ＥＬ発光層12及び第２電極層13を覆うように、実施例１と同様の封止剤20によってガラス基板10に接合されている。本実施例の有機ＥＬ表示装置では、封止部材２’が実施例１及び実施例２の伸縮部３と同様に機能し、温度の変動によって封止部材２’が膨張及び収縮することで封入空間４の体積が増減され内圧の変動が吸収されるので、封止剤20に大きな応力が作用するのが防止されている。

【００３１】すなわち本実施例では、封止部材２’の全部が伸縮部を兼ねている。

【００３２】

【発明の効果】すなわち本発明の有機ＥＬ表示装置によれば、温度の変動によって封入空間の内圧が変動しても、伸縮部の伸縮により封入空間の体積が変動し内圧の変動が吸収される。したがって封止剤などに過大な応力が作用するのが防止され、長寿命の有機ＥＬ表示装置とすることができる。

【図面の簡単な説明】

【図１】本発明の一実施例の有機ＥＬ表示装置の断面図である。

【図２】本発明の第２の実施例の有機ＥＬ表示装置の断面図である。

【図３】本発明の第３の実施例の有機ＥＬ表示装置の断面図である。

【図４】従来の有機ＥＬ表示装置の断面図である。

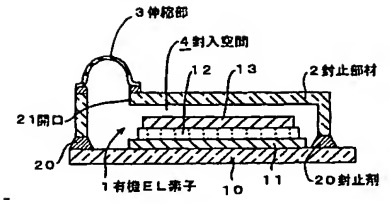
【符号の説明】

１：有機ＥＬ素子　　２：封止部材

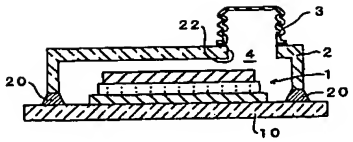
３：伸縮部

４：封入空間

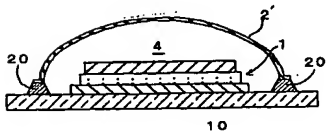
【図１】


3伸縮部
4封入空間
12
13
2封止部材
21開口
20
1有機ＥＬ素子
10
11
20封止剤

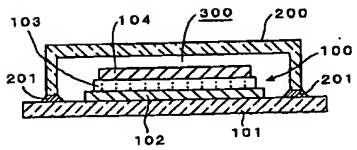
【図２】


22
3
4
2
1
20
20
10

【図３】


2'
4
1
20
20
10

【図４】


103
104
300
200
100
201
201
102
101

JP 11-339954

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CLAIMS

[Claim(s)]
[Claim 1] Organic [which is characterized by providing the following] The organic EL element which consists of the 1st electrode layer formed on the substrate and this substrate, an organic EL luminous layer formed on this 1st electrode layer, and the 2nd electrode layer formed on this organic EL luminous layer. organic EL display which comes to enclose an inactive substance in the enclosure space which consists of a closure member which closes this organic EL element airtightly, and is formed between this organic EL element and this closure member -- setting -- this closure -- flexible ******** ** **** which a member expands and contracts possible [increase and decrease of the volume of this enclosure space] at least in part

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[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to organic EL display which closed airtightly the organic EL element with the luminous layer which consists of an organic material.
[0002]
[Description of the Prior Art] As a display device for a display, the Braun tube (Cathode Ray Tube), liquid crystal (Liquid Crystal), plasma (Plasma), light emitting diode (Light EmittingDiode), EL (Electro Luminescence), etc. are known conventionally, and are widely used for the back panel of the display for computers, and a liquid crystal display etc.
[0003] Since EL is spontaneous light type and it can consider as a thin film also in this, it is expected as a thin display device. And as thin film type direct current EL, the organic thin film EL which can be driven by the low battery attracts attention in recent years. For example, although red, green, and the element that emits light efficiently in the blue three primary colors are required in order to consider as the display for full color, about blue, there is only a low material of luminous efficiency inorganic [EL]. However, according to organic [EL], the element for which blue can also emit light efficiently is developed, and the application to the display for full color is studied briskly.
[0004] However, an organic luminescent material used for an organic EL element has the fault that water resistance is low and a life becomes short with moisture. Moreover, metal electrodes, such as Mg alloy used for the organic EL element, also have the fault that the resistance over water or oxygen is low. then, the former -- an organic EL element -- closure -- a member -- it closes inside and organic EL display which enclosed nitrogen gas etc. in the enclosure space formed between an organic EL element and a closure member is used
[0005] For example, the conventional organic EL display shown in drawing 4 is an organic EL element. It consists of 100 and closure glass 200. Among these, organic EL element 100 is a glass substrate. 101 and glass substrate The transparent-electrode layer 102 and transparent-electrode layers, such as ITO (indium stannic-acid ghost) formed on 101 Organic EL luminous layer formed on 102 103 and metal-electrode layer formed on the organic EL luminous layer 103 It consists of 104. Moreover, closure glass 200 is nothing and closure glass about box-like [which has opening in the whole surface]. The opening periphery section of 200 is a glass substrate. They are encapsulants, such as adhesives, to 200. It is joined by 201.
[0006] With this organic EL display, it is an organic EL element. 100 and closure glass A closed space is formed by 200 and it is an organic EL element. 100 and closure glass Enclosure space formed among 200 300 is filled up with nitrogen gas. With this organic EL display, it is a transparent-electrode layer. 102, organic EL layer In order that it may be intercepted with the exterior and only nitrogen gas may contact, deteriorating 103 and the metal-electrode layer 104 becomes prevented long lasting.
[0007]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional organic EL display, the pressure of the nitrogen gas enclosed by change of temperature is changed, and internal

pressure becomes high under an elevated temperature. Therefore, the stress by the internal pressure which became high is a rigid low encapsulant. It acted on 201 etc. and there was fault of reducing the reliability of organic EL display.
[0008] this invention is made in view of such a situation, change of internal pressure is made small by improvement of the closure structure of organic EL display, and it aims at raising reliability.
[0009]
[Means for Solving the Problem] The feature of organic EL display of this invention which solves the above-mentioned technical problem The organic EL element which consists of the 1st electrode layer formed on the substrate and the substrate, an organic EL luminous layer formed on the 1st electrode layer, and the 2nd electrode layer formed on organic EL luminous layer, organic EL display which comes to enclose an inactive substance in the enclosure space which consists of a closure member which closes an organic EL element airtightly, and is formed between an organic EL element and a closure member -- setting -- closure -- it is in having had the flexible section which a member expands and contracts possible [increase and decrease of the volume of enclosure space] at least in part
[0010]
[Embodiments of the Invention] organic EL display of this invention -- closure -- it has the flexible section which a member expands and contracts possible [increase and decrease of the volume of enclosure space] at least in part Therefore, if internal pressure is changed by change of temperature, since the flexible section will expand and contract in connection with it, and the volume of enclosure space will be fluctuated, change of internal pressure is eased by Boyle Charles's principle.
[0011] For example, if internal pressure becomes high under an elevated temperature, since the flexible section will expand and the volume of enclosure space will increase, internal pressure falls. Moreover, if internal pressure becomes low under low temperature, in order that the flexible section may contract and the volume of enclosure space may decrease, internal pressure rises. Therefore, in organic EL display of this invention, even if it changes temperature, since there is little change of the internal pressure of enclosure space, it is prevented that stress acts on an encapsulant etc. and reliability improves.
[0012] Things used conventionally, such as what formed the 1st electrode layer from the ITO film etc., for example on the glass substrate, formed organic EL luminous layer on the 1st electrode layer as an organic EL element, and formed the 2nd electrode layer on organic EL luminous layer, can be used. As a substrate, although a glass substrate is usually used, a synthetic-resin substrate can also be used. Moreover, although the substrate is generally transparent, a substrate can also be made opaque if a transparent thing is used for the 2nd electrode layer.
[0013] as the material of the 1st electrode layer -- the former -- the same -- ITO, AZO (aluminum addition ZnO), and SnO2 etc. -- it is illustrated and the 1st electrode layer is formed by sputtering etc. Especially the pattern of the 1st electrode layer is not restricted, but can be formed in the same pattern as the former, such as the shape of a stripe. Although it is necessary to also use this 1st electrode layer as a transparent-electrode layer from ITO etc. when making light emit from a substrate side using a transparent substrate, when making light emit from the 2nd electrode side, using the 2nd electrode layer as transparent, the 1st electrode layer can also be formed from an opaque conductive metal.
[0014] Organic EL luminous layer can consist of an electron hole transporting bed, an emitter layer formed on the electron hole transporting bed, and an electronic transporting bed formed on the emitter layer as usual. This organic EL luminous layer can be formed using a vacuum deposition method, a langue MYUABURO jet vacuum deposition, the DIP coating method, the spin coating method, a vacuum gas vacuum deposition, an organic molecular-beam-epitaxy method, etc.
[0015] As a material of the 2nd electrode layer, conductive metals, such as an Mg-Ag alloy and aluminum, are illustrated. Since this 2nd electrode layer forms on organic EL luminous layer, it is not used by the forming-membranes method elevated temperatures, such as sputtering, act. Therefore, it is chosen from the material which can be formed by the vacuum deposition etc. As a closure member, glass, a resin, etc. can be used as usual, and an organic EL element will not be restricted especially if the configuration is a wrap thing. Moreover, it can join to the substrate of an organic EL element by encapsulants, such as adhesives, and a closure member may constitute enclosure space with an organic

EL element, can constitute enclosure space only from a closure member, and can also close an organic EL element to the interior.
[0016] Generally the interval of a closure member and the 2nd electrode layer of an organic EL element is. It is referred to as 100 to 200 micrometer. When this interval is too narrow, there is a possibility that a closure member and an organic EL element may contact and an organic EL element may be damaged. moreover -- as the inactive substance enclosed in enclosure space -- an organic EL element and closure -- the inactive liquid of inert gas, such as nitrogen gas, gaseous helium, and argon gas, or a fluorine system can be used to a member and an encapsulant that what is necessary is just inactive
[0017] the greatest feature of this invention -- closure -- it is in the place equipped with the flexible section which a member expands and contracts possible [increase and decrease of the volume of enclosure space] at least in part as this flexible section -- the shape of the shape for example, of a balloon, or bellows -- closure -- it can consider as the elastic heights which project from a part of member By preparing such heights, if the internal pressure of enclosure space is changed by temperature change, heights will expand or contract. Since the volume of enclosure space is changed by this, the stress which the internal pressure of enclosure space moves in the direction in which a difference with the original internal pressure becomes small, and acts on an encapsulant etc. becomes small.
[0018] the case where the flexible section is made into heights -- the flexible section -- closure -- it is airtightly joined to opening of a member Although what is necessary is just to join physically [this junction] or chemically, since it is necessary to join so that an airtight may not be destroyed at the time of expansion and contraction of the flexible section, it is desirable to use together both physical junction and chemical junction, such as adhesion. moreover, closure -- a member -- also let the whole be the flexible section for example, opening of airtight bags, such as rubber, -- the glass substrate of an organic EL element -- joining -- closure -- if the internal pressure of enclosure space is changed by the member, then temperature change -- closure -- a member -- the very thing expands or contracts Since the volume of enclosure space is changed by this, the stress which the internal pressure of enclosure space moves in the direction in which a difference with the original internal pressure becomes small, and acts on an encapsulant etc. becomes small.
[0019] As the quality of the material of the flexible section, it has resistance to the inactive substance enclosed, and the thing of resin systems, such as a thing of rubber systems, such as a fluororubber and isobutylene isoprene rubber, thermoplastic elastomer, and a polybutadiene, etc. is illustrated that what is necessary is just what is expanded and contracted according to expansion and contraction of an inactive substance.
[0020]
[Example] Hereafter, an example explains this invention concretely.
(Example 1) The cross section of organic EL display of this invention is shown in drawing 1 . this organic EL display -- organic EL element 1 and closure -- it consists of a member 2 and the flexible section 3
[0021] Organic EL element 1 consists of the glass substrate 10, a 1st electrode layer 11 which consists of an ITO film formed on the glass substrate 10, an organic EL luminous layer 12 formed on the 1st electrode layer 11, and a 2nd electrode layer 13 which is formed on the organic EL luminous layer 12, and consists of an Mg-Ag alloy. The 1st electrode layer 11 is formed in the shape of a stripe on a glass substrate 10 of sputtering, and the thickness is 1000-2000A. Moreover, the organic EL luminous layer 12 consists of an electron hole transporting bed formed the whole surface on the 1st electrode layer 11 and a glass substrate 10, an emitter layer formed on the electron hole transporting bed, and an electronic transporting bed formed on the emitter layer, it is formed of a vacuum deposition from a respectively well-known organic material, and the whole thickness has become 1000-1500A.
[0022] the [and] -- 2 electrode layers 13 are formed in 1500-2000A in thickness of a vacuum deposition through a mask, and serve as the shape of a stripe which intersects perpendicularly to the 1st electrode layer 11 Therefore, this organic EL element 1 emits light by impressing direct current voltage to the organic EL luminous layer 12 through the 1st electrode layer 11 and the 2nd electrode layer 13, and the luminescence penetrates the transparent 1st electrode layer 11 and a transparent glass substrate

10, and is checked by looking from a glass-substrate 10 side. If the predetermined point of the matrix formed in the 1st electrode layer 11 and the 2nd electrode layer 13 again is chosen and energized, since the point will serve as a pixel, it becomes possible to display a picture as a display.
[0023] closure -- a member 2 is formed in box-like from a glass plate -- having -- the opening periphery section -- the [the 1st electrode layer 11 of organic EL element 1, the organic EL luminous layer 12, and] -- 2 electrode layers 13 -- a wrap -- it is joined to the glass substrate 10 by the encapsulant 20 like and closure -- opening 21 is formed in a part of upper surface of a member 2, and the opening periphery section of the flexible section 3 of a saccate is airtightly joined to the periphery section of opening 21 This opening 21 is countered and formed in the 1st electrode layer 11 and the front face of the glass substrate 10 expressed without reaching organic EL luminous layer 12 and the 2nd electrode layer 13 existing.
[0024] The flexible section 3 is formed in the airtight saccate from the elastic fluororubber. and the opening periphery section of the flexible section 3 joins to the periphery section of opening 21 airtightly -- having -- a glass substrate 10 and closure -- the airtight enclosure space 4 is formed of a member 2 and the flexible section 3 in addition, the volume of the enclosure space 4 -- the whole -- 1.5cm3 it is -- the capacity in the flexible section 3 -- 1.5cm3 it is . the glass substrate 10 by the encapsulant 20, and closure -- the junction to a member 2, and closure -- ultraviolet-rays hardening type adhesives are used for junction of a member 2 and the flexible section 3 Thus, fault it becomes an elevated temperature at the time of adhesion, and organic EL element 1 deteriorates by using ultraviolet-rays hardening type adhesives is prevented.
[0025] Nitrogen gas is enclosed with the enclosure space 4, and the pressure is set to it so that it may become one atmospheric pressure in a room temperature (25 degrees C). enclosure of the nitrogen gas to the enclosure space 4 -- closure -- what joined the flexible section 3 to the member 2 beforehand -- the inside of nitrogen gas -- encapsulant It can carry out by joining to the glass substrate 10 of organic EL element 1 by 20. In organic EL display of this example, since nitrogen gas is enclosed in the enclosure space 4, it is prevented that organic EL element 1 deteriorates by moisture or oxygen. And expansion of the nitrogen gas enclosed by temperature serving as an elevated temperature expands the flexible section 3 with the pressure. The pressure of nitrogen gas declines by this, and it is balancing after the shrinkage force by the elasticity of the flexible section 3 and the pressure of nitrogen gas have balanced. Therefore, it is prevented that big stress acts on the closure section 20, and it can lengthen the life of the organic EL display device 1.
[0026] Moreover, if temperature serves as low temperature and the pressure of nitrogen gas declines, the flexible section 3 will contract and the volume of the enclosure space 4 will become small. Since the pressure of nitrogen gas rises by this, it is prevented that big stress acts on the closure section 20 with the pressure from the atmosphere. if temperature furthermore falls -- the flexible section 3 -- closure -- although the case where it invades into the inside of a member 2 can be considered -- opening 21 -- the [the 1st electrode layer 11, the organic EL luminous layer 12, and] -- since 2 electrode layers 13 are countered and formed in the front face of the glass substrate 10 existed and expressed, there is no fault which the flexible section 3 contacts organic EL element 1, and organic EL element 1 damages
[0027] (Example 2) Organic EL display of this example is shown in drawing 2 . this organic EL display -- the configuration of the flexible section 3, and closure -- it is constituted like the example 1 except the junction positions to a member 2 differing expansion and contraction -- the bellows configuration with which, as for the member 3, the end section was closed -- the periphery section of nothing and its other end opening -- closure -- it is joined to the periphery section of the opening 22 of a member 2 Moreover, opening 22 is countered and formed in organic EL element 1.
[0028] In organic EL display of this example, it is prevented that the flexible section 3 acts like the flexible section 3 of an example 1 at the time of an elevated temperature and low temperature, and big stress acts on an encapsulant 20. and -- even if it becomes very low temperature and the flexible section 3 contracts greatly -- the flexible section 3 -- the bellows section -- closure -- since invading into the inside of a member 2 is regulated, there is no fault which contacts organic EL element 1
[0029] therefore -- according to organic EL display of this example -- organic EL display of an example

1 -- comparing -- closure -- the flexibility of the position of the opening 22 of a member 2 is high (Example 3) Organic EL display of this example is shown in drawing 3 . the organic EL element 1 as an example 1 with this same organic EL display, and elasticity closure -- it consists of member 2'
[0030] closure -- a member -- 2' is formed in an airtight saccate from a fluororubber -- having -- the opening periphery section -- the [the 1st electrode layer 11 of organic EL element 1, the organic EL luminous layer 12, and] -- 2 electrode layers 13 -- a wrap -- it is joined to the glass substrate 10 like by the same encapsulant 20 as an example 1 organic EL display of this example -- closure -- a member -- 2' -- the flexible section 3 of an example 1 and an example 2 -- the same -- functioning -- change of temperature -- closure -- a member -- since the volume of the enclosure space 4 is fluctuated because 2' expands and contracts, and change of internal pressure is absorbed, it is prevented that big stress acts on an encapsulant 20
[0031] namely, -- this example -- closure -- a member -- all of 2' serve as the flexible section
[0032]
[Effect of the Invention] That is, according to organic EL display of this invention, even if it changes the internal pressure of enclosure space by change of temperature, the volume of enclosure space is changed by expansion and contraction of the flexible section, and change of internal pressure is absorbed. Therefore, it is prevented that excessive stress acts on an encapsulant etc. and it can consider as long lasting organic EL display.

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to organic EL display which closed airtightly the organic EL element with the luminous layer which consists of an organic material.

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EFFECT OF THE INVENTION

[Effect of the Invention] That is, according to organic EL display of this invention, even if it changes the internal pressure of enclosure space by change of temperature, the volume of enclosure space is changed by expansion and contraction of the flexible section, and change of internal pressure is absorbed. Therefore, it is prevented that excessive stress acts on an encapsulant etc. and it can consider as long lasting organic EL display.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional organic EL display, the pressure of the nitrogen gas enclosed by change of temperature is changed, and internal pressure becomes high under an elevated temperature. Therefore, the stress by the internal pressure which became high is a rigid low encapsulant. It acted on 201 etc. and there was fault of reducing the reliability of organic EL display.
[0008] this invention is made in view of such a situation, change of internal pressure is made small by improvement of the closure structure of organic EL display, and it aims at raising reliability.

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MEANS

[Means for Solving the Problem] The feature of organic EL display of this invention which solves the above-mentioned technical problem The organic EL element which consists of the 1st electrode layer formed on the substrate and the substrate, an organic EL luminous layer formed on the 1st electrode layer, and the 2nd electrode layer formed on organic EL luminous layer, organic EL display which comes to enclose an inactive substance in the enclosure space which consists of a closure member which closes an organic EL element airtightly, and is formed between an organic EL element and a closure member -- setting -- closure -- it is in having had the flexible section which a member expands and contracts possible [increase and decrease of the volume of enclosure space] at least in part
[0010]
[Embodiments of the Invention] organic EL display of this invention -- closure -- it has the flexible section which a member expands and contracts possible [increase and decrease of the volume of enclosure space] at least in part Therefore, if internal pressure is changed by change of temperature, since the flexible section will expand and contract in connection with it, and the volume of enclosure space will be fluctuated, change of internal pressure is eased by Boyle Charles's principle.
[0011] For example, if internal pressure becomes high under an elevated temperature, since the flexible section will expand and the volume of enclosure space will increase, internal pressure falls. Moreover, if internal pressure becomes low under low temperature, in order that the flexible section may contract and the volume of enclosure space may decrease, internal pressure rises. Therefore, in organic EL display of this invention, even if it changes temperature, since there is little change of the internal pressure of enclosure space, it is prevented that stress acts on an encapsulant etc. and reliability improves.
[0012] Things used conventionally, such as what formed the 1st electrode layer from the ITO film etc., for example on the glass substrate, formed organic EL luminous layer on the 1st electrode layer as an organic EL element, and formed the 2nd electrode layer on organic EL luminous layer, can be used. As a substrate, although a glass substrate is usually used, a synthetic-resin substrate can also be used. Moreover, although the substrate is generally transparent, a substrate can also be made opaque if a transparent thing is used for the 2nd electrode layer.
[0013] as the material of the 1st electrode layer -- the former -- the same -- ITO, AZO (aluminum addition ZnO), and SnO2 etc. -- it is illustrated and the 1st electrode layer is formed by sputtering etc. Especially the pattern of the 1st electrode layer is not restricted, but can be formed in the same pattern as the former, such as the shape of a stripe. Although it is necessary to also use this 1st electrode layer as a transparent-electrode layer from ITO etc. when making light emit from a substrate side using a transparent substrate, when making light emit from the 2nd electrode side, using the 2nd electrode layer as transparent, the 1st electrode layer can also be formed from an opaque conductive metal.
[0014] Organic EL luminous layer can consist of an electron hole transporting bed, an emitter layer formed on the electron hole transporting bed, and an electronic transporting bed formed on the emitter layer as usual. This organic EL luminous layer can be formed using a vacuum deposition method, a langue MYUABURO jet vacuum deposition, the DIP coating method, the spin coating method, a vacuum gas vacuum deposition, an organic molecular-beam-epitaxy method, etc.

[0015] As a material of the 2nd electrode layer, conductive metals, such as an Mg-Ag alloy and aluminum, are illustrated. Since this 2nd electrode layer forms on organic EL luminous layer, it is not used by the forming-membranes method elevated temperatures, such as sputtering, act. Therefore, it is chosen from the material which can be formed by the vacuum deposition etc. As a closure member, glass, a resin, etc. can be used as usual, and an organic EL element will not be restricted especially if the configuration is a wrap thing. Moreover, it can join to the substrate of an organic EL element by encapsulants, such as adhesives, and a closure member may constitute enclosure space with an organic EL element, can constitute enclosure space only from a closure member, and can also close an organic EL element to the interior.
[0016] Generally the interval of a closure member and the 2nd electrode layer of an organic EL element is. It is referred to as 100 to 200 micrometer. When this interval is too narrow, there is a possibility that a closure member and an organic EL element may contact and an organic EL element may be damaged. moreover -- as the inactive substance enclosed in enclosure space -- an organic EL element and closure -- the inactive liquid of inert gas, such as nitrogen gas, gaseous helium, and argon gas, or a fluorine system can be used to a member and an encapsulant that what is necessary is just inactive
[0017] the greatest feature of this invention -- closure -- it is in the place equipped with the flexible section which a member expands and contracts possible [increase and decrease of the volume of enclosure space] at least in part as this flexible section -- the shape of the shape for example, of a balloon, or bellows -- closure -- it can consider as the elastic heights which project from a part of member By preparing such heights, if the internal pressure of enclosure space is changed by temperature change, heights will expand or contract. Since the volume of enclosure space is changed by this, the stress which the internal pressure of enclosure space moves in the direction in which a difference with the original internal pressure becomes small, and acts on an encapsulant etc. becomes small.
[0018] the case where the flexible section is made into heights -- the flexible section -- closure -- it is airtightly joined to opening of a member Although what is necessary is just to join physically [this junction] or chemically, since it is necessary to join so that an airtight may not be destroyed at the time of expansion and contraction of the flexible section, it is desirable to use together both physical junction and chemical junction, such as adhesion. moreover, closure -- a member -- also let the whole be the flexible section for example, opening of airtight bags, such as rubber, -- the glass substrate of an organic EL element -- joining -- closure -- if the internal pressure of enclosure space is changed by the member, then temperature change -- closure -- a member -- the very thing expands or contracts Since the volume of enclosure space is changed by this, the stress which the internal pressure of enclosure space moves in the direction in which a difference with the original internal pressure becomes small, and acts on an encapsulant etc. becomes small.
[0019] As the quality of the material of the flexible section, it has resistance to the inactive substance enclosed, and the thing of resin systems, such as a thing of rubber systems, such as a fluororubber and isobutylene isoprene rubber, thermoplastic elastomer, and a polybutadiene, etc. is illustrated that what is necessary is just what is expanded and contracted according to expansion and contraction of an inactive substance.

[Translation done.]

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EXAMPLE

[Example] Hereafter, an example explains this invention concretely.
(Example 1) The cross section of organic EL display of this invention is shown in drawing 1 . this organic EL display -- organic EL element 1 and closure -- it consists of a member 2 and the flexible section 3
[0021] Organic EL element 1 consists of the glass substrate 10, a 1st electrode layer 11 which consists of an ITO film formed on the glass substrate 10, an organic EL luminous layer 12 formed on the 1st electrode layer 11, and a 2nd electrode layer 13 which is formed on the organic EL luminous layer 12, and consists of an Mg-Ag alloy. The 1st electrode layer 11 is formed in the shape of a stripe on a glass substrate 10 of sputtering, and the thickness is 1000-2000A. Moreover, the organic EL luminous layer 12 consists of an electron hole transporting bed formed the whole surface on the 1st electrode layer 11 and a glass substrate 10, an emitter layer formed on the electron hole transporting bed, and an electronic transporting bed formed on the emitter layer, it is formed of a vacuum deposition from a respectively well-known organic material, and the whole thickness has become 1000-1500A.
[0022] the [and] -- 2 electrode layers 13 are formed in 1500-2000A in thickness of a vacuum deposition through a mask, and serve as the shape of a stripe which intersects perpendicularly to the 1st electrode layer 11 Therefore, this organic EL element 1 emits light by impressing direct current voltage to the organic EL luminous layer 12 through the 1st electrode layer 11 and the 2nd electrode layer 13, and the luminescence penetrates the transparent 1st electrode layer 11 and a transparent glass substrate 10, and is checked by looking from a glass-substrate 10 side. If the predetermined point of the matrix formed in the 1st electrode layer 11 and the 2nd electrode layer 13 again is chosen and energized, since the point will serve as a pixel, it becomes possible to display a picture as a display.
[0023] closure -- a member 2 is formed in box-like from a glass plate -- having -- the opening periphery section -- the [the 1st electrode layer 11 of organic EL element 1, the organic EL luminous layer 12, and] -- 2 electrode layers 13 -- a wrap -- it is joined to the glass substrate 10 by the encapsulant 20 like and closure -- opening 21 is formed in a part of upper surface of a member 2, and the opening periphery section of the flexible section 3 of a saccate is airtightly joined to the periphery section of opening 21 This opening 21 is countered and formed in the 1st electrode layer 11 and the front face of the glass substrate 10 expressed without reaching organic EL luminous layer 12 and the 2nd electrode layer 13 existing.
[0024] The flexible section 3 is formed in the airtight saccate from the elastic fluororubber. and the opening periphery section of the flexible section 3 joins to the periphery section of opening 21 airtightly -- having -- a glass substrate 10 and closure -- the airtight enclosure space 4 is formed of a member 2 and the flexible section 3 in addition, the volume of the enclosure space 4 -- the whole -- 1.5cm3 it is -- the capacity in the flexible section 3 -- 1.5cm3 it is . the glass substrate 10 by the encapsulant 20, and closure -- the junction to a member 2, and closure -- ultraviolet-rays hardening type adhesives are used for junction of a member 2 and the flexible section 3 Thus, fault it becomes an elevated temperature at the time of adhesion, and organic EL element 1 deteriorates by using ultraviolet-rays hardening type adhesives is prevented.

[0025] Nitrogen gas is enclosed with the enclosure space 4, and the pressure is set to it so that it may become one atmospheric pressure in a room temperature (25 degrees C). enclosure of the nitrogen gas to the enclosure space 4 -- closure -- what joined the flexible section 3 to the member 2 beforehand -- the inside of nitrogen gas -- encapsulant It can carry out by joining to the glass substrate 10 of organic EL element 1 by 20. In organic EL display of this example, since nitrogen gas is enclosed in the enclosure space 4, it is prevented that organic EL element 1 deteriorates by moisture or oxygen. And expansion of the nitrogen gas enclosed by temperature serving as an elevated temperature expands the flexible section 3 with the pressure. The pressure of nitrogen gas declines by this, and it is balancing after the shrinkage force by the elasticity of the flexible section 3 and the pressure of nitrogen gas have balanced. Therefore, it is prevented that big stress acts on the closure section 20, and it can lengthen the life of the organic EL display device 1.

[0026] Moreover, if temperature serves as low temperature and the pressure of nitrogen gas declines, the flexible section 3 will contract and the volume of the enclosure space 4 will become small. Since the pressure of nitrogen gas rises by this, it is prevented that big stress acts on the closure section 20 with the pressure from the atmosphere. if temperature furthermore falls -- the flexible section 3 -- closure -- although the case where it invades into the inside of a member 2 can be considered -- opening 21 -- the [the 1st electrode layer 11, the organic EL luminous layer 12, and] -- since 2 electrode layers 13 are countered and formed in the front face of the glass substrate 10 existed and expressed, there is no fault which the flexible section 3 contacts organic EL element 1, and organic EL element 1 damages

[0027] (Example 2) Organic EL display of this example is shown in drawing 2 . this organic EL display -- the configuration of the flexible section 3, and closure -- it is constituted like the example 1 except the junction positions to a member 2 differing expansion and contraction -- the bellows configuration with which, as for the member 3, the end section was closed -- the periphery section of nothing and its other end opening -- closure -- it is joined to the periphery section of the opening 22 of a member 2 Moreover, opening 22 is countered and formed in organic EL element 1.

[0028] In organic EL display of this example, it is prevented that the flexible section 3 acts like the flexible section 3 of an example 1 at the time of an elevated temperature and low temperature, and big stress acts on an encapsulant 20. and -- even if it becomes low temperature extremely and the flexible section 3 contracts greatly -- the flexible section 3 -- the bellows section -- closure -- since invading into the inside of a member 2 is regulated, there is no fault which contacts organic EL element 1

[0029] therefore -- according to organic EL display of this example -- organic EL display of an example 1 -- comparing -- closure -- the flexibility of the position of the opening 22 of a member 2 is high (Example 3) Organic EL display of this example is shown in drawing 3 . the organic EL element 1 as an example 1 with this same organic EL display, and elasticity closure -- it consists of member 2'

[0030] closure -- a member -- 2' is formed in an airtight saccate from a fluororubber -- having -- the opening periphery section -- the [the 1st electrode layer 11 of organic EL element 1, the organic EL luminous layer 12, and] -- 2 electrode layers 13 -- a wrap -- it is joined to the glass substrate 10 like by the same encapsulant 20 as an example 1 organic EL display of this example -- closure -- a member -- 2' -- the flexible section 3 of an example 1 and an example 2 -- the same -- functioning -- change of temperature -- closure -- a member -- since the volume of the enclosure space 4 is fluctuated because 2' expands and contracts, and change of internal pressure is absorbed, it is prevented that big stress acts on an encapsulant 20

[0031] namely, -- this example -- closure -- a member -- all of 2' serve as the flexible section

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[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cross section of organic EL display of one example of this invention.
[Drawing 2] It is the cross section of organic EL display of the 2nd example of this invention.
[Drawing 3] It is the cross section of organic EL display of the 3rd example of this invention.
[Drawing 4] It is the cross section of the conventional organic EL display.
[Description of Notations]
1: organic EL element 2: -- closure -- member The 3:flexible section
4: Enclosure space

[Translation done.]

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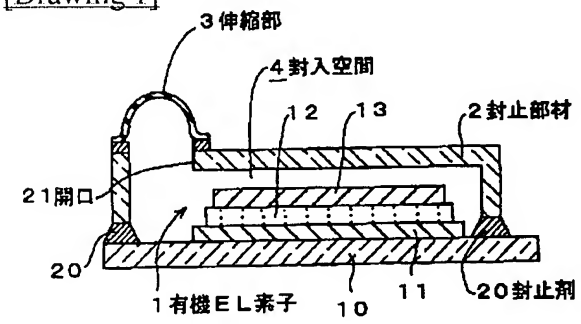
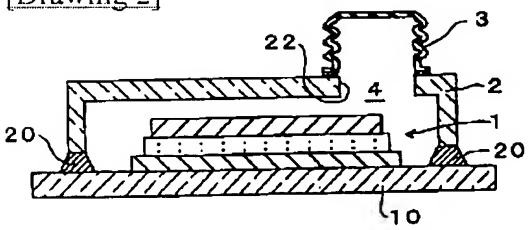
DRAWINGS

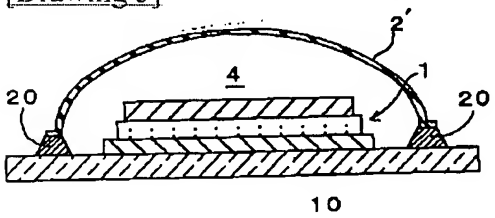
[Drawing 1]



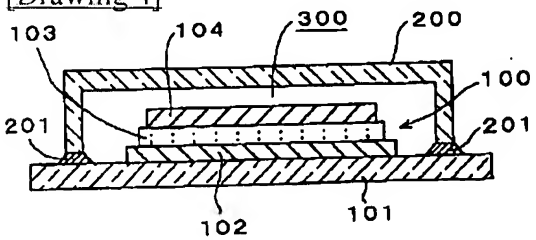
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]